Space Weather Technical Forecast

Issued on Saturday, 08 July 2023 at 01:42 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of R1/R2 radio blackouts throughout. Slight chance G1/Minor Storm today.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate, with an M-class flare reaching M4.0 at 07/0629UTC from AR3359, which is located in the southwest. There are nine numbered sunspot regions on the visible disc. AR3363 is the largest region on the visible disc, and is still close to the southeast limb. No Earth-directed CMEs detected in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind as observed at L1, was predominantly at slightly elevated levels, and on occasion reached elevated levels and is currently at around 460km/s. Total magnetic field strength was at moderate levels to start, between 8-10 nT, declining steadily to current weak levels around 6nT. The north-south component, Bz, varied weakly to start, but became predominantly weakly negative, around -6nT, from around 07/0630. The phi angle was positive (towards the Sun) for much of the period, becoming briefly negative between 071800 and 07/2200 UTC. Geomagnetic activity has been largely Quiet to Unsettled Kp 2-3) but with two Active Kp4 intervals recorded.

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV), as observed by GOES16, was at background levels. High energy electron flux (greater than 2MeV), as observed by GOES16, was at background to moderate levels, with a peak around 650 pfu at 07/1435 UTC. The 24-hour integrated fluence was below the Active (1e8 integrated pfu) threshold and steady. A fluence of 1.612e7 pfu was recorded at 08/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: A continuation of generally Low to Moderate activity is expected through the period, with a slight chance of an isolated X-class flare. No major active region forecast to depart the visible disk during the period and far side sounding data suggesting further regions may rotate onto the disk into days 3 and 4 (10-11 July).

Solar Wind / Geomagnetic Activity: A continuation of the slightly-elevated to elevated solar winds expected to start the period, with continued influence likely from positive coronal hole 22. This expected to decline from day 2 (9 July) onwards, with limited influence expected from coronal hole 21 in the southern disk. Some influence remains possible from a partial halo CME which left the Sun on 4 July, but this low confidence, with signs that it may have already passed through. Therefore the solar wind is expected to start at slightly elevated to elevated or possibly strong day 1, then decline to slightly elevated or slow levels by day 4.
Geomagnetic activity is forecast to be Unsettled to Active (Kp 3-4) with a slight chance remaining of G1/Minor (Kp5) storm intervals day 1. Geomagnetic activity expected to reduce steadily from day 2 onwards, becoming generally Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: The high energy (greater than 10MeV) proton flux has a

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slight but increasing chance of reaching the S1/Minor Storm threshold through the period. High energy electron flux (greater than 2MeV) is expected to remain at background to moderate levels today, then from day 2 onwards a steady increase in diurnal peaks is likely, probably breaching the High threshold (1000 pfu) at times. Electron fluence low at first but seeing an increasing chance of rising above the Active threshold (1e8 integrated flux) into the period.

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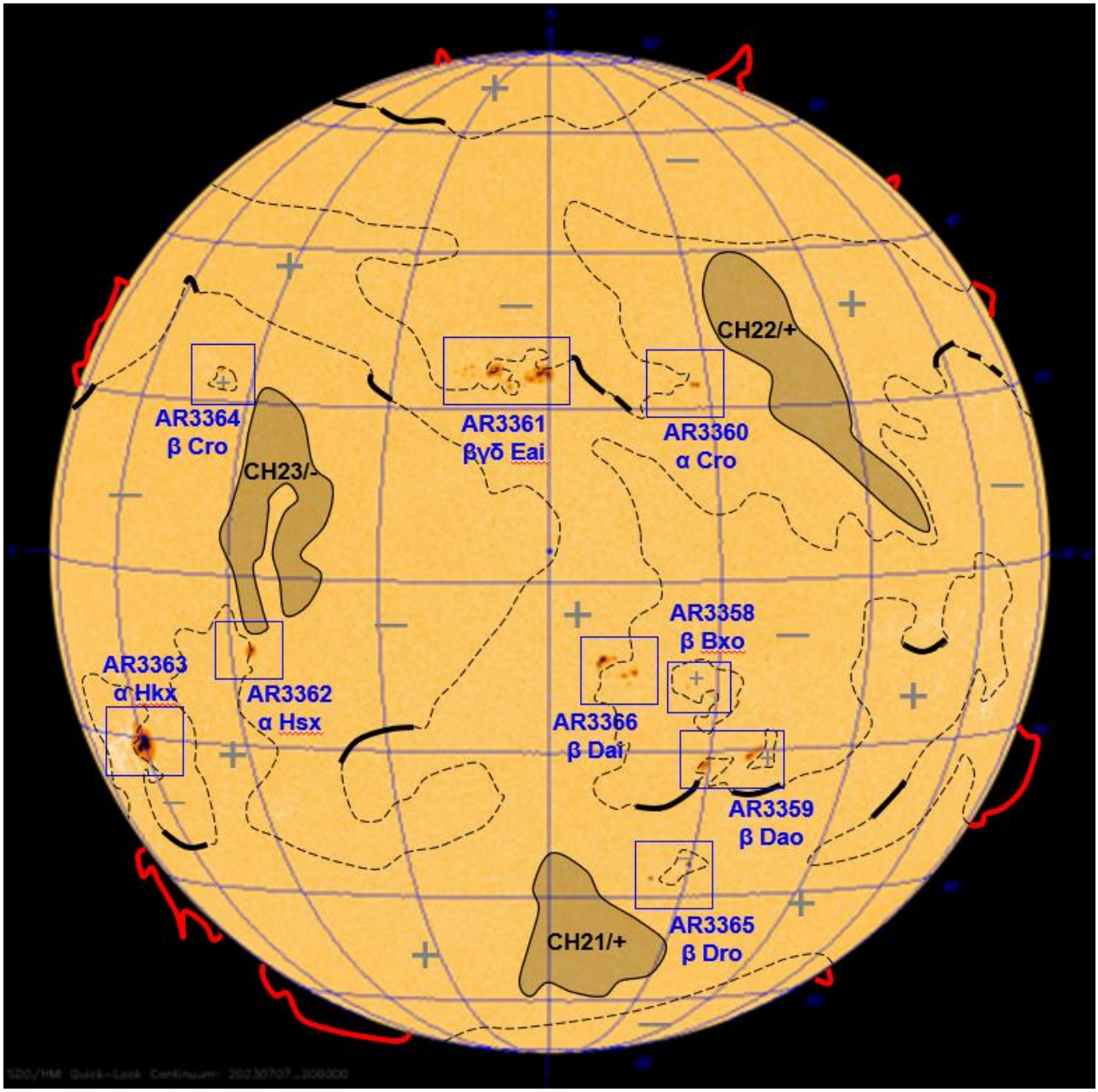
Figure 1. Solar Analysis Valid 07/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:
A continuation of the slightly-elevated to elevated solar winds expected to start the period, with continued influence likely from positive coronal hole 22. This expected to decline from day 2 (9 July) onwards, with limited influence expected from coronal hole 21 in the southern disk. Some influence remains possible from a partial halo CME which left the Sun on 4 July, but this low confidence, with signs that it may have already passed through. Therefore the solar wind is expected to start at slightly elevated to elevated, or possibly strong levels day 1, then decline to slightly elevated or slow levels by day 4.

Geomagnetic activity is forecast to be Unsettled to Active (Kp 3-4) with a slight chance remaining of G1/Minor (Kp5) storm intervals day 1. Geomagnetic activity expected to reduce steadily from day 2 onwards, becoming generally Quiet to Unsettled (Kp 1-3).

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	20	5	1	1
Strong	G3	No	5	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

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Radio Blackouts - X-Ray Flares:
Solar activity Moderate in the last 24hrs, with an M4.0 flare observed from AR3359 at 07/0629 UTC. There are 9 sunspot regions on the visible disc. Of these AR3361 (now Eai/Beta-Gamma-delta) remains the most complex and active region, with continued slight development and a small delta spot now visible within the trailing portion. The newly numbered region AR3366 also continues its recent development although some signs of increasing maturity in in the leading and trailing spots, now Dai/Beta. All other regions have shown little significant change in recent hours, appearing generally small or generally stable, including the large region AR3363 in the southeast quadrant.

A continuation of generally Low to Moderate activity is expected through the period, with a slight chance of an isolated X-class flare. No major active region forecast to depart the visible disk during the period and far side sounding data suggesting further regions may rotate onto the disk into days 3 and 4 (10-11 July).

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	40	40	40	40
Very Active	R3 to R5 X Class	No	5	5	5	5

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Solar Radiation Storms - (High Energy Protons):
The high energy (greater than 10MeV) proton flux, as observed by GOES16, is currently at background levels. There is a slight chance of S1/Minor storm levels being reached through this period, with this risk increasing into days 3 and 4 (10-11 July) as current active regions increasingly rotate into the western hemisphere.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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High Energy Electrons Event (≥ 2MeV):
High energy electron flux (greater than 2MeV) is expected to remain at background to moderate levels day 1 (8 July). From day 2 onwards a steady increase in diurnal peaks is expected, perhaps breaching the High threshold (1000 pfu) at times. Electron fluence currently below the Active threshold (1e8 integrated flux), with only a slight increasing trend forecast in the Met Office REFM model, this viewed as likely too low, with an increasing chance preferred.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	10	20	30	50
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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